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BUREAU OF DAIRY INDUSTRY

CIRCULAR No. 167 JUNE, 1931
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

MOSS PEAT, ITS USES AND DISTRIBUTION IN THE UNITED STATES

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IMPORTS OF MOSS PEAT

Within the last decade a quantity of moss peat from Europe has appeared on the markets of this country and has served to bring consideration of this product to the foreground. By far the greater part of the imports originates in Germany and the Netherlands, but recent statistical reports indicate that Sweden, Finland, and to less extent Russia, Norway, and Canada are beginning to supply moss peat for consumption in the United States. Table 1, a summary of peat imports, compiled from records of the Bureau of Foreign and Domestic Commerce and the Bureau of Mines of the United States Department of Commerce, shows the steadily increasing amounts and value and serves as a basis for arriving at some conclusion regarding the future possibilities of the moss-peat industry.

TABLE 1.—*Imports of moss peat for consumption in the United States, 1919–1930*

Year	Quantity	Value	Year	Quantity	Value
	Short tons	*Dollars*		*Short tons*	*Dollars*
1919	464	16, 435	1925	10, 233	121, 719
1920	2, 762	36, 201	1926	16, 669	174, 261
1921	3, 450	22, 754	1927	31, 595	326, 549
1922	4, 805	33, 034	1928	41, 735	433, 111
1923	5, 973	43, 184	1929	58, 006	744, 528
1924	5, 541	47, 208	1930	95, 028	869, 391

CHARACTERISTIC PROPERTIES OF MOSS PEAT

Moss peat can scarcely be classed as a manufactured product, since it consists chiefly of the poorly decomposed stems and leaves derived from several species of Sphagnum mosses. Photographs

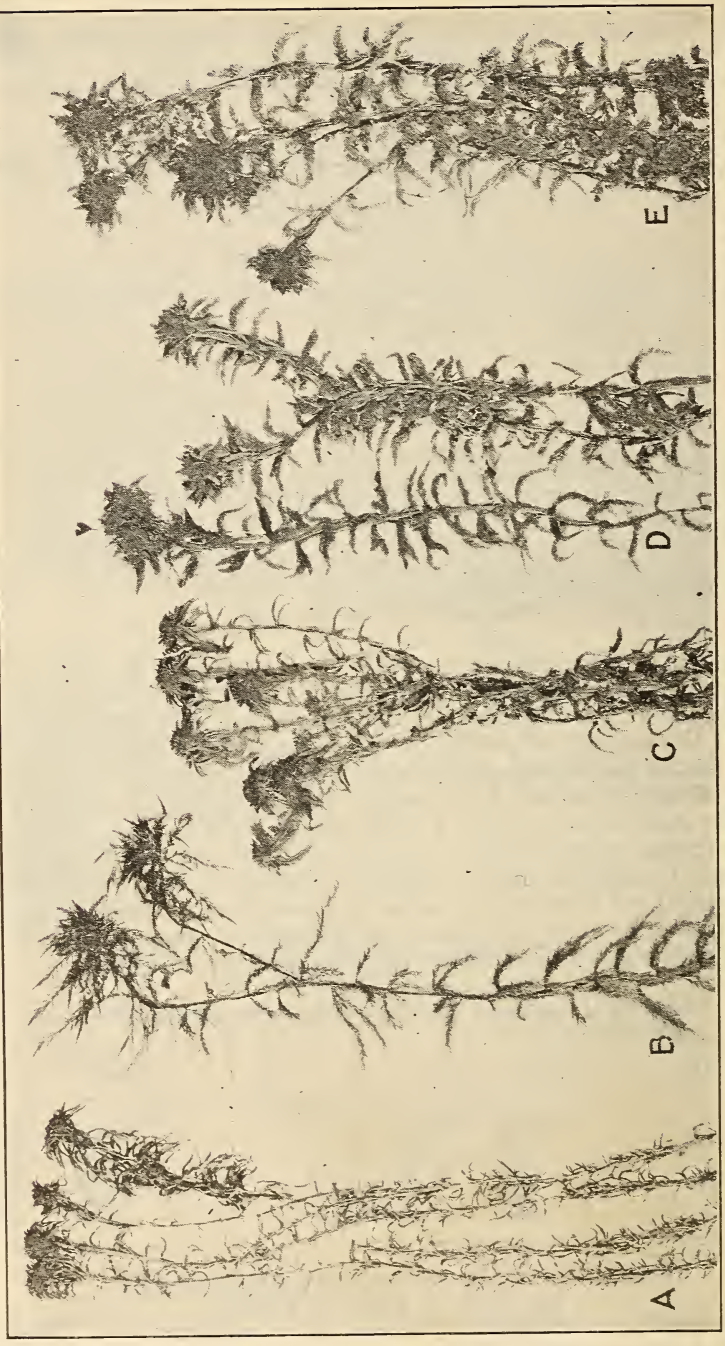

FIGURE 1.—Species of peat-forming mosses: A, *Sphagnum fuscum*; B, *S. cuspidatum*; C, *S. acutifolium*; D, *S. medium*; E, *S. magellanicum*. (Photographs from collections in the U. S. National Herbarium)

of important peat-forming mosses, collected in this country, are shown in Figure 1. The plants have no true roots such as are found on sedges, reeds, or saw grass. All the species of Sphagnum are widely distributed throughout the world, but the region of optimum growth is limited by certain climatic conditions. These mosses thrive best and accumulate as layers of peat within a belt occupying cool and humid regions extending from northern Europe to Asia and North America. In the United States the limits appear to coincide closely with the northern coniferous forest and the group of soils represented by the podsols.

Moss peat is light in weight, porous fibrous to spongy fibrous in texture, crumbly or compact but fairly elastic, and of a yellow-brown color when dry. Some of it contains a moderate mixture of stringy-fibrous tufts from cotton grass, but is rather free from woody material of shrubs or trees, extraneous mineral matter, and other impurities. Different varieties of American moss peat are shown in Figure 2.

In recent years the imports of moss peat have been increasing, largely because of the uniformly high quality of the imported article. But lately large quantities of lower grade and moist moss peat are being sold on our markets. Unless the material is graded with a suitable range of differentiation for quality, the better product can not command a price in keeping with its quality.

The distinguishing characteristics between moss peat and other types of peat are not generally understood. In the case of sedge peat or that derived from reeds, tules, or saw grass, the material is felty matted and reddish brown to grayish brown in color. It consists almost wholly of an intricate network of slender roots and rootlets. A drawback to this type of peat is its tendency to become brittle when dry and to break down to a fine-grained dust. Likewise the brown peat derived from species of Hypnum mosses, and dark-colored, largely decomposed woody, as well as sedimentary, types of peat, are not advantageous for some of the purposes mentioned below regarding the uses of Sphagnum-moss peat. Several kinds of peat are described in Department Bulletin 802 (*1*),[1] and photographs to aid in their identification are shown in Department Bulletin 1419 (*3*), both of which are issued by the United States Department of Agriculture.

No attempt is made in this circular to give an extended discussion of the physical properties and chemical composition of moss peat. Analyses have been published in Department Bulletin 802 (*1*) and more recently in Technical Bulletin 214 (*5*) of the United States Department of Agriculture. The results of these analyses and of those reported by other investigators indicate that moss peat obtained from Maine is very similar to that imported from Europe. The research now going forward in the laboratories of this bureau has brought to light facts as to what constitutes a high-quality product of moss peat for the consumer. The high absorption capacity of a good quality of air-dried moss peat is demonstrated by the fact that it will hold from fifteen to thirty times its own weight of water. Material which has been dried artificially by the application of heat loses its water-absorbing capacity to a very marked

[1] Italic numbers in parentheses refer to Literature cited, p. 11.

degree, rendering the product less fit for use. Analyses show also that moss peat is strongly acid, having a pH value ranging from

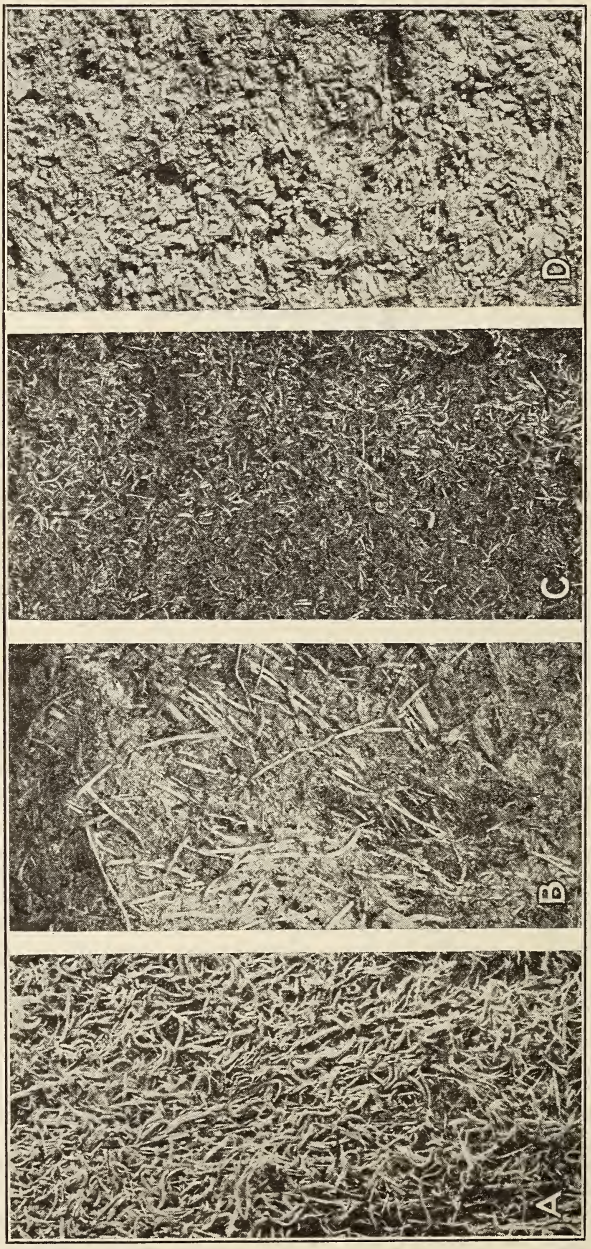

FIGURE 2.—Varieties of Sphagnum-moss peat: A, Coarsely fibrous, porous; B, partly fibrous, firm; C, fibrous, crumbly; D, fibrous, spongy. (Photographs natural size, from air-dry samples)

3.5 to 4.5. The chemical composition of the plant remains is characterized by a content of about 12 to 18 per cent cellulose and an amount of hemicellulose averaging 23 per cent. The content of

ligninlike complexes is very low, less than 30 per cent. The material is also low in nitrogen and ash, the content of nitrogen varying from 0.5 to 1 per cent and that of ash from 1 to 4 per cent. The mineral constituents in the ash are on the average very low in fertilizer value; the ratio of alumina to iron oxide, however, is high, owing to the character of the underlying mineral soils which in northern regions are in general derived from glacial drift.

The felty-matted, root-formed, or "radicellate" sedge and reed peats, on the other hand, are characterized by a higher ash content and a slightly acid or nearly alkaline reaction. There is also a tendency toward a higher content of relatively inert lignin complexes, and there are appreciably smaller amounts of available carbon compounds such as cellulose. This condition reflects in part a more advanced degree of decomposition, but is largely due to the fact that roots of sedges and grasslike plants contain tissue more resistant to alteration after death than the aerial, leafy shoots.

USES OF MOSS PEAT

Moss peat is used in this country principally as an absorbing and deodorizing material and for ameliorating the physical condition of mineral soils. Moss peat is easily handled, provides a loose, clean, sanitary bedding for horses, cattle, and other livestock, and undergoes decay relatively slowly. It absorbs and retains liquid manure more completely than do other kinds of litter, decreases losses in available nitrogen, prevents odors, and checks insect pests in dairy barns, stables of riding and race horses, and sheds for poultry and for fur-bearing animals. In addition to its sanitary features moss peat furnishes organic matter for soils. Peat is not a fertilizer, but considerable importance is attached to its value as a composting material, as a conditioner or filler for concentrated mineral fertilizers, and as an absorbent in places where sewer systems have not been constructed.

In a finely shredded condition moss peat serves various horticultural purposes. It is used as a medium for germinating seeds, to start cuttings, to transplant and grow evergreens and heaths, and to propagate rare orchids. As a mulch it protects plants and soil against the effects of alternate freezing and thawing and keeps down weeds. The use of different kinds of peat is receiving continued attention in the greenhouses and on lawns and golf courses. As a source of organic material and ingredient of topsoil and top-dressing, and for the improvement of soil texture the results have been favorable where from one-fourth to one-half of the total volume of the soil is peat with the addition of manure or fertilizers as a means of overcoming the deficiency of soluble plant-food constituents. Combinations of moss peat in a series of tests with clay are shown in Figure 3.

The relatively sterile property of moss peat meets the requirements as a storing or packing material for the shipment of perishable articles, such as fruits, vegetables, tubers, and bulbs, to distant markets. It holds the required moisture for a considerable length of time and acts as an insulator against heat and cold during shipment. This use of moss peat might be extended to include the packing and storing of certain animal products.

A few species of peat-forming Sphagnum mosses were used for surgical dressings in the World War, and the absorbent and de-

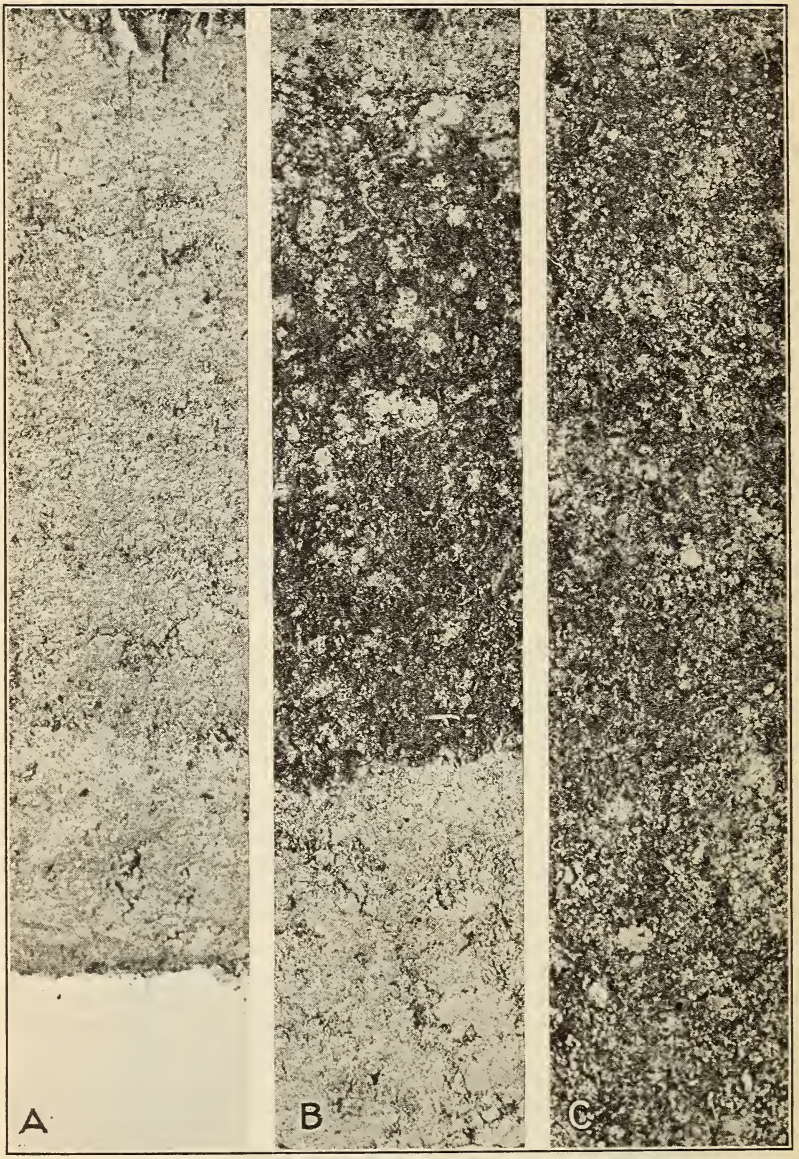

FIGURE 3.—Vertical cross sections showing a heavy clay soil (A) to which moss peat has been added as a source of organic matter and for improving its permeability to moisture, air, and the roots of plants. In (B) one-half by volume of the soil is moss peat; in (C) one-third of the volume is moss peat, one-third being sand, and one-third clay. (Photograph natural size)

odorizing properties of moss peat are said to have a special value in mattresses and sanitary appliances for hospital use. It is doubtful, however, whether in view of the superiority of substances now

in general use for the same purposes the adoption of peat substitutes is warranted.

GENERAL REQUIREMENTS FOR A SUCCESSFUL MOSS-PEAT INDUSTRY

The utilization of moss peat for a variety of purposes has served to increase interest in the character of the deposits in the United States. It is recognized that a great difference exists between peat materials and that areas of organic origin show a considerable range in structural features. The commercial development of peat deposits differing in the natural arrangement and thickness of the peat layers has served to emphasize this point through the unsatisfactory results obtained in this country. For many years it has been reported that the United States contains deposits of moss peat, but the location of workable deposits and the quantity of suitable material are not well known. The failure of all attempts to produce moss peat in the United States and the financial losses of enterprises in the past must be attributed to the lack of basic information.

Essential economic considerations demand that for successful manufacture of moss-peat products a number of important factors must be taken into account. Any commercial utilization of peat in competition with other available special products requires careful study of several field conditions affecting an area of peat.

Deposits which are forested or have many buried stumps and logs should be avoided. The layer of moss peat is less decomposed and of a better quality where the surface vegetation consists of an open growth of low, dwarfed shrubs such as Labrador-tea, pale laurel, leatherleaf, wild rosemary, cranberry, and other species, and where trees have not yet become established.

Too much importance can scarcely be attached to the quality of the material, the thickness of the layers, and the degree of preservation of moss peat available in a deposit. It is essential that the layers be of uniform grade and quality. Moss peat of good quality and grade must have a high water-absorbing capacity, a moderately high content of cellulose, and a relatively low amount of woody material and ash. Reliable information must therefore be obtained in all cases on the degree of decomposition and the amount of moss peat available before an attempt is made to establish a commercial enterprise.

Deposits of limited acreage or of slight average depth will not justify exploitation except for local needs. For the manufacture of moss peat on a large scale an extensive acreage is required, and the layer of good moss peat should average considerably more than 3 feet in depth. The quantity in a given deposit may be found with sufficient accuracy for all practical purposes by determining the total acreage and assuming that at least 150 tons of air-dry moss peat can be obtained from each acre for each foot in depth.

Closely connected with the factors mentioned are considerations of the facilities for transportation with respect to roads and water routes. It is important also to be assured of a choice of location in which the climatic conditions are suitable for the atmospheric dehydration of the moss peat and that the prospects are favorable for controlling drainage and for the subsequent utilization of the

land. Methods have been pointed out in Department Bulletin 1419 (*3*) for sounding areas of peat to determine variations in depth and in structural profile features.

One of the big problems of an American moss-peat industry is to meet the better quality of the imported material. A comparatively full knowledge of the character of any area of peat can be obtained

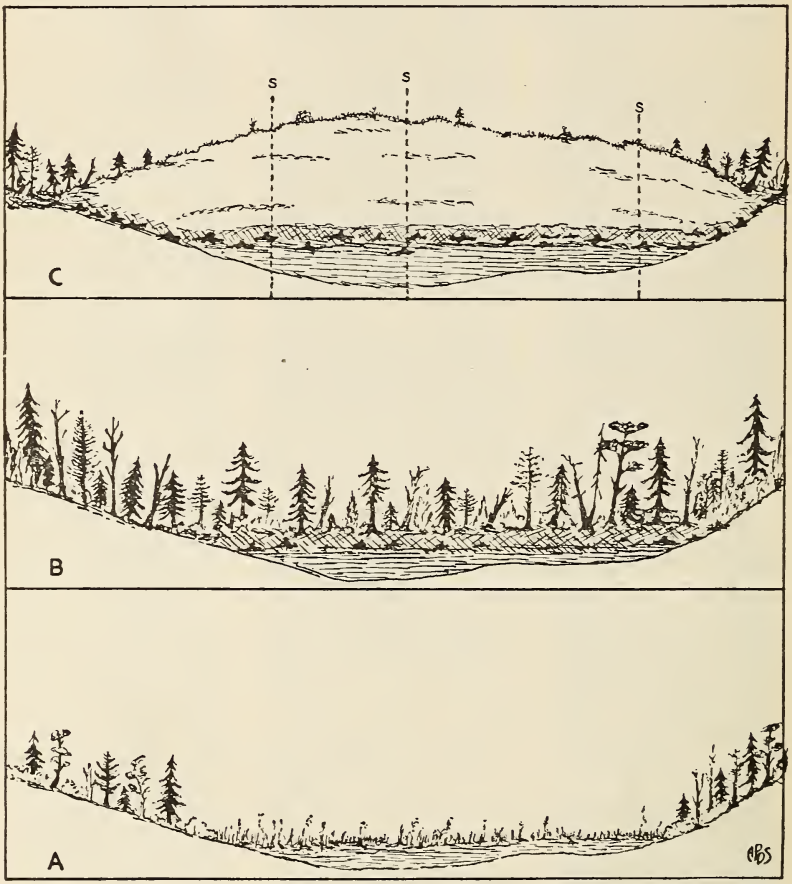

FIGURE 4.—Diagram illustrating the origin, development, and structure of a "high moor" or dome-shaped deposit of moss peat on the northeastern coast of Maine. Tree major units of vegetation displaced one another: A, a marsh; B, a coniferous swamp forest; C, mosses with plants characteristic of the Arctic regions. The succession of vegetation formed a sequence of layers from sedge peat to woody peat and moss peat, each layer differing in composition, thickness, and fundamental properties. Profile soundings are indicated at S

only by investigating the vertical cross sections in the entire profile under field conditions, for only thus can the sequence and the composition and thickness of each layer be understood. The structural framework of a peat deposit, when properly determined, serves a very concrete and practical purpose. Figure 4 illustrates the structural features of a deposit of moss peat in Maine, and the vertical profile section (fig. 5) reveals the history of the development and

shows the main layers of peat in a European "high-moor." Illustrations of this kind bring out the possibilities of commercial utilization and the conditions under which drainage, excavation, and the manufacture of moss-peat products may take place.

The selection of areas that are profitable for economic development is an important factor. It is a better policy to preserve in their natural condition peat lands which are commercially and agriculturally undesirable, or to convert them to flood control, reforestation, wild-life reserves, and recreational uses.

The technical procedure connected with the manufacture of moss-peat products will be found described in a circular of the United States Department of Agriculture (*2*). Information concerning methods and machinery is available also in bulletins issued by the United States Department of the Interior (*4*, *7*), and in a bulletin published by the United States Department of Commerce (*6*). It may suffice to state that the process consists of cutting the moss-peat layer into blocks, spreading them to dry in the air, and tearing the blocks to pieces by the use of simple shredding machinery. The air-dried, shredded material is passed through rotary screens, graded, and packed. Moss peat is supplied in two or three grades, the finely shredded material being designated as mull, or granulated moss peat.

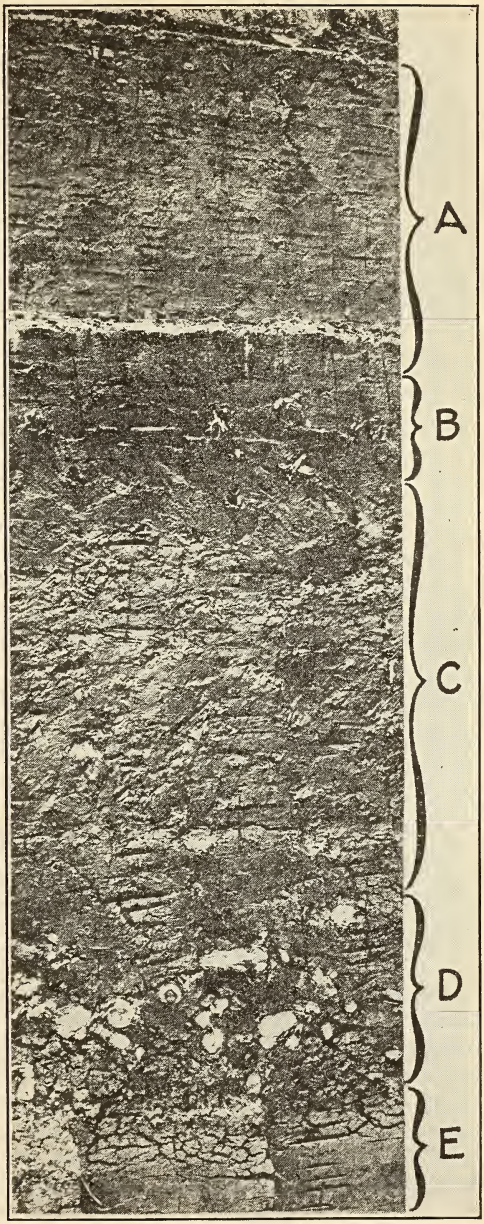

FIGURE 5.—Vertical cross section of a European deposit of moss peat, showing a well-marked sequence of peat layers. At the surface is (A) a layer of yellow-brown Sphagnum-moss peat used for the manufacture of bedding, litter, and other exported peat products. It is underlain by (B) a thin layer of woody peat, below which occurs (C) a dark-brown, largely decomposed layer of moss peat used chiefly as fuel. Farther down (D) are the stumps of an ancient forest of coniferous trees rooted in (E) a basal layer of compacted reed and sedge peat

Very large quantities of moss peat are produced in Europe at a comparatively low cost owing to the use of efficient modern machinery for cutting, spreading, and stacking blocks of peat, transporting them by aerial conveyors to the shredding plant, and compressing the material into burlap-covered bales, wire bound and protected by wooden staves, for oversea shipping. The sale unit is the bale. The standard bale contains one-third cubic meter (about 12 cubic feet) of moss peat with a moisture content ranging from 20 to 30 per cent and weighs approximately 80 kilos (176 pounds). The industry is growing so rapidly that facts relating to more recent methods, processes, and machinery employed in the commercial production of moss peat should receive more careful attention.

FIGURE 6.—Map showing the location of deposits from which samples of moss peat were obtained. The dome-shaped "heaths" of Washington County in northeastern Maine contain moss peat of commercial significance. The dotted lines inclose regions requiring further investigation

THE DISTRIBUTION OF MOSS PEAT IN THE UNITED STATES

The peat resources of the United States have been estimated to cover an area of more than 100,000,000 acres. Of this total area only a small proportion is likely to contain moss peat. The number and acreage of moss-peat deposits available for commercial development and their location with reference to shipping points and centers of population is not well known. With the chief exception of Soil Survey reports of recent date for counties in Michigan and a few scientific publications, to which reference is made in the bulletins cited, no adequate investigation has been made of the thickness and quality of moss-peat deposits in this country. In view of this lack of information a sketch map has been prepared showing the location of areas known to have a surface layer of moss peat at least 1 foot in thickness. The map shown in Figure 6 should be regarded merely as expressing the distribution of small outliers from a belt of optimum development in the northern United States. It embraces numerous areas which are too small or which represent merely floating mats of moss peat of no commercial significance.

The map suggests, however, the possible existence of three centers as a promising supply of desirable moss peat. They occur in Maine, in the northern part of Wisconsin and Minnesota, and along the Pacific coast in northern Washington and Alaska. These centers can not be differentiated because of incomplete knowledge, and they should therefore receive further study. For the development of a moss-peat industry on a large scale the dome-shaped heaths in Washington County, Me., appear to offer superior advantages. They resemble European "high moors" in having a raised surface layer of moss peat ranging from 5 to 8 feet in thickness and in being located near the coast, with facilities for shipment by vessels. But before these deposits or any others are exploited, careful tests and analyses should be made so that the uncertainty relative to the total quantity of good moss peat available can be eliminated.

Inasmuch as the importation of moss peat during the last few years amounts to nearly $2,000,000 in value and its consumption in this country is continually growing, the desirability of a systematic investigation of American peat resources and their possibilities for uses other than farming is very evident.

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